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ABSTRACT

Simplification of text as a pedagogical technique in second language instruction implies: (1) the selection of a restricted set of features from the full range of foreign language resources (linguistic simplification) and/or (2) the rearrangement of content of foreign language messages (content simplification) for purposes of instructional efficiency. The second option is more central to the communicative approach to language teaching, where a minimal level of formal linguistic competence is necessary for well-defined and restricted communication tasks; the first option results in just a contrived laboratory text. Both types of simplification result in a reduction of authenticity. Factors accompanying the simplification of instructional materials include lexical factors such as word frequency, degree of abstractness, lexical density, paraphrasing, and substitution of word meaning for connotations; syntactic factors such as sentence splitting, deletion of irrelevant information, or addition of examples or glosses; and text and discourse factors such as temporal organization of segments, text organization with reference to the main topic and subtopics, theme progression, and addition of metatext. The use of some parameters of simplification is illustrated with a sample text and two simplications. Two pages of references are included. (MSE)

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SOME PARAMETERS OF SIMPLIFICATION

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SOME PARAMETERS OF SIMPLIFICATION

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The concept of simplification has an immediate connection with the topics of language learning, acquisition, and teaching. In this paper, a brief review is given of some definitions of the term and of some parameters of simplification as a materials production technique. The use of these parameters is illustrated with a sample text and two simplifications. The general points offered in this paper will be followed, in a later article, by a quantitative analysis of linguistic devices employed in a series of published simplifications which will be compared with their original versions.

Definitions of simplification

The terms simplify and simplification have been used to refer to at least the following things:

(1) A hypothetical "learning strategy" in the process of second or foreign language acquisition (Richards 1975). Simplification here mainly denotes the principle of rule economisation as an aspect of learner behaviour. The learner attempts to account for a maximum amount of input data with a minimum number of rule hypotheses in order to achieve savings in the processing of the data. Thus, for example, such errors as overgeneralisations may be interpreted as a result of simplification processes operating during the formation of the learner's interlanguage system. This interpretation is objected to by Corder (1977) on logical grounds. According to him, the standard foreign language system is rather acquired through a process of complexification. Here a universal, semantically based simple system, to which the learner has access by virtue of his own development as a L1 acquirer, is gradually elaborated in the course of the development of the interlanguage system. A similar development presumably takes place in the case of pidgin codes, where the starting point is again the universal basic structure of natural language. When the interlanguage achieves a certain degree of adequacy as a vehicle for a range of transactions, further elaboration of the system may be aborted, which leads to stabilisation and

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possibly fossilisation. The resulting system displays a restricted range of structural characteristics.

(2) The term has also been used to refer to the process by which a fully competent native speaker temporarily regresses to a simpler and often institutionalised register of his language for stylistic and sociolinguistic reasons (cf. Ferguson 1971). Examples of simplification in this sense include foreigner-talk, motherese, or telegraphese. These may be taken to involve a simplified rhetoric, not a simpler code (cf. Corder 1977; 1979). The speaker's communicative ability enables him to adapt his utterances according to addressee or situation along a continuum ranging from the full resources of the language to a narrow selection of linguistic devices.

(3) Related to (2) above is the definition of simplification as a process whereby, in the context of a foreign language teaching operation, the teacher or materials producer makes various adjustments in the language presented to the learner. As a pedagogical process, simplification implies firstly the selection of a restricted set of features from the full range of FL resources for purposes of pedagogic efficiency. The code is obviously not affected: the learners are not presented with a simpler language system but a restricted sample of the full system. A second aspect of simplification in this sense is the rearrangement of the content of the FL messages used as teaching materials.

The purpose and nature of simplification as a pedagogical technique

Simplification of written texts intended for FL learning materials thus comes in two main types: linguistic and content simplification (cf. Honeyfield 1977), the former dealing with the linguistic forms of 'usage', the latter involving the manipulation of 'use' (rhetorical devices, discourse organisation; cf. Widdowson 1979). A typical case of simplification in the former sense is the decontextualisation and idealisation of learning material within structurally organised syllabuses: the foreign language is presented through carefully chosen sets of non-authentic sentences or dialogues exemplifying structural learning points. Simplification is here clearly the "pedagogic analogue of the linguist's idealisation of data" (Widdowson 1979). Its purpose is to hold constant as many as possible of those FL variables which are irrelevant to the structural point being handled by the text. The second type, content simplification, seems to be central for the communicative approach to language teaching, where a characteristic preoccupation is with the minimal level of formal linguistic

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competence needed to perform certain well-defined and often restricted communication tasks. Here a learning text is seen chiefly as a set of acts of communication such as introducing the topic, presenting arguments, drawing conclusions, exemplifying, persuading, informing, etc. The essential task of the learner is seen to be the comprehension of meaning and of the communicative functions present in the text. From this point of view, the central aim of simplification is both making the linguistic forms "as unobtrusive as possible ... and their communicative function as obvious as possible" (Allen and Widdowson 1978).

The former type of simplification produces, in Widdowson's terminology, a 'simplified version', a contrived laboratory text. The latter process results in a 'simple account', ie. a genuine piece of discourse, with information rearranged so as to maximally facilitate the learner's processing of propositional and illocutionary content. It is clearly possible to simplify a text merely by lexical and syntactic substitution without changing the arrangement of content information. Presumably it is equally possible to produce a simple account (ie. to improve on the original organisation of content), and leave lexis and syntax untouched. The distinction is therefore useful in theory. However, it is difficult to find a simplified version where the informational sequence has not been changed at least by deletion, ie. abridgement. Similarly, most simple accounts would also seem to involve modification of 'usage', since they involve a selection of 'unobtrusive' linguistic forms rather than those one would use in authentic discourse. Thus in practice the binary division is perhaps less clear-cut than Widdowson implies.

As language-learning texts, both simplified versions and simple accounts involve a reduction of authenticity, at least if by an authentic text one means a piece of discourse aimed at native-language readers. The simplifier aims at facilitating the learner's processing task (comprehension, learning) by doing part of the processing in advance, so that the learner's energies may be concentrated on the essential learning points contained in the text. The realisation of this aim seems to presuppose some knowledge of a set of parameters of processing complexity for FL learners. One way of obtaining this knowledge is the systematic investigation of the nature of receptive FL processing. Relatively little seems to have been done along these lines, however. Another possible approach is to study the relationship between reception and production: the utterances learners produce presumably reflect what is simple for them, and simplifiers might well utilise information about discrepancies between receptive per-

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formance on the one hand, and controlled ('monitored') and automatic ('unmonitored') production performance on the other. These approaches would, then, start from experimental investigations of FL reception and production, and would extract factors that could be manipulated in the construction of simplified materials.

In general, however, simplification as a pedagogic technique seems to rely on the simplifier's intuitions and experience as teacher. The study of what happens in simplification consequently involves the description of the intuitive strategies used by the simplifier. This is essentially the approach that will be adopted in the later study; the same approach was used by Lautamatti (1978; 1979) in her observations on the text-linguistic characteristics of simplified materials. The logical next step within this approach would appear to be the experimental verification of the generalisations drawn from simplification data. Ideally, the simplification strategies derived from simplifier behaviour should be put under empirical test, since what the materials producer considers to be simple may in fact not be so for the learners. The practical aim of analyses of simplifications and of their use as materials in tests of processing complexity is obvious: the parameters isolated and found effective in this way can be usefully employed in the production of teaching materials of various kinds.

Some parameters of simplification

As a preliminary to later empirical work, it seems useful to consider some potential factors one would expect to find in simplified materials. The variables manipulated in simplification can be conveniently divided into lexical, syntactic, and discourse features. In the following, a brief general comment will be given on each. The operation of some of these variables will be illustrated with a concrete example involving an original passage (Appendix A), and two simplifications (Appendices B and C). The examples used to illustrate vocabulary and syntax simplification will be drawn from version B, in which the qualities of a simplified version are emphasised by leaving the original discourse structure relatively intact. The examples used to illustrate some discourse and text parameters are drawn from version C, essentially a simple account.

Lexical factors. A traditional feature in a host of readability formulae developed to predict the ease of processing of texts is word frequency, normally measured objectively by a word count in a set of materials, as in Thorndike and Lorge (1944). Native speakers recognise frequent words

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more efficiently than infrequent words; they prefer to use them, and they also comprehend and learn them with less effort. The frequency of a word's occurrence undoubtedly serves as an important factor in the internalisation of the intra-word redundancies which are the basis for expectancies typical of fluent processing. In foreign language teaching, it is naturally important to base vocabulary selection on the words which the student will be likely to encounter, and lexical simplification therefore includes the adaptation of vocabulary according to frequency considerations.

Another example of a possible lexical parameter is the semantic characteristic of concreteness or abstractness. In general, though not completely consistently, native-speaker results from word recognition experiments indicate that concreteness facilitates processing (cf. Gibson and Levin 1975). Concreteness is probably important in choosing or adapting texts for learners of a foreign language as well. Beginners' language processing is facilitated by the use of vocabulary which is learnable through ostensive procedures and immediately connected with real-world objects rather than combinations of other words.

In the production of a simplification, the application of such parameters normally results in paraphrasing, as the use of a restricted selection of vocabulary tends to provide few exact synonyms for original words. This usually has the effect of reducing the lexical density of the original. If the lexical density of a sentence (the ratio of content words to the total number of words) is a factor in processing complexity, as is suggested by Perfetti (1969), such paraphrases and expansions should have a facilitating effect on processing.

A small selection of typical lexical simplification strategies may be illustrated from version B, which concentrates mainly on vocabulary and syntax modification. If a suitable high-frequency item is readily available, it is substituted for a low-frequency item, as in sentence 2 of version B (B:2), where the word meaning appears instead of the original words definitions and connotations (A:3). Usually, however, expansion and the consequent reduction of lexical density accompanies the introduction of high-frequency words in the simplification of Latinate vocabulary or technical terms:

leonine roar (A:12) - the roar of a lion (B:19)

pupillary contraction (A:14) - the adjustment the eye makes to bright light (B:22)

Sometimes the provision of these 'prompting glossaries' (Widdowson 1978) within the simplified version requires more extensive syntactic reorganisation and addition of information. An example of this is the third sentence

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of the original version, where the notions of slot-machine on the one hand, and instantaneous, predictable and stereotyped behaviour, on the other, have necessitated a concrete explanation:

> A: 3 ... we are the more justified to call an organism's behaviour 'reflex' the more it resembles the action of a mechanical slot-machine; that is to say, the more instantaneous, predictable, and stereotyped it is.
>
> B:4-5 ... an organism's behaviour is reflex-like if it resembles the action of a cigarette machine: when you put in a coin, you know what you will receive; the machine produces the cigarettes at once; and it always responds in the same way. In other words, reflexes are typically predictable, instantaneous, and stereotyped.

In general, the psycholinguistic effect of vocabulary simplification is to reduce the learner's need for redundancy utilisation or 'inferencing' (cf. Carton 1971). The processing task of the less advanced learner is eased by avoiding situations where native-like fluency in inferring vocabulary from context would be expected. The simplification of lexis also has a direct influence on syntactic structure through expansion. To some extent, the reformulations and additions of information needed in lexical simplification can also bring the resulting version close to what is understood by a simple account. Abridgement has a similar effect.

Syntactic factors. Together with lexical parameters, modifications of sentence structures and length are often mentioned as typical parameters of simplified versions. In spite of a great number of psycholinguistic experiments, it remains, however, uncertain what kinds of structural factors actually contribute to processing complexity in the case of the native speaker or foreign language learner, and some psycholinguists would probably feel inclined to greatly de-emphasise the role of syntax.

However, one common assumption seems to be that the reduction of sentences into a series of simple kernels makes processing easier for the learner and native speaker alike. This is in line with the result from the early experiments on the Derivational Theory of Complexity: even though quantitative predictions concerning transformational processes may not hold, it still remains a fact that the surface structure of some sentences is less complex to handle than that of others. The segmentation of original sentences into smaller units naturally also reduces sentence length; however, this factor in itself is not necessarily related to processing complexity (cf., for example, Coleman 1962, who noted that dividing coordinated sentences into independent main clauses has no simplifying effect on the processing task). Another possible syntactic parameter is the frequency of the surface structure patterns employed: writing the text in high-fre-

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quency structures (normally corresponding to the syntactically simpler constructions) may make the learner's task easier (cf. Pierce 1973).

Psycholinguistic research with native speakers has also indicated that nominalisations, deletions from surface structure of markers of syntactic relations (e.g. relative pronoun and complementizer deletions), embedding, and left-branching constituent structure may be factors in processing complexity (cf. Coleman and Blumenfield 1963; Fodor and Garrett 1967; Hakes and Cairns 1970; Hakes 1972). Corresponding research with foreign language learners is scantier, but it seems reasonable to suppose that similar principles govern foreign language processing as well. Features such as these could therefore be taken into account in syntactic simplification.

Text B provides examples of parameters listed above. The chief syntactic simplification technique in text B has been the splitting up of sentences. For example, the content of A:3 has been spread out over sentences 2-5 of version B. This strategy is reflected in the number of sentences: the original text (A) has 18, while version B has 30. The mean sentence length in words has also dropped considerably (A=29.6; B=18.0), in spite of the fact that splitting and lexical simplification together tend to add words to sentences.

The change from the density typical of complex sentences towards the use of simple main clauses, i.e. dilution of sentence structure, is also reflected in the conversion of prepositional phrases into independent causes, e.g.

> in a stereotyped pattern (A:5) - The pattern of this muscle action is stereotyped (B:7).

or in the conversion of nominalisations into their finite-verb counterparts:

> electric stimulation of the zygomatic major (A:7) - If the zygomatic major ... is stimulated ... (B:10)

or in the conversion of reduced clauses into full sentences, as in

> scale... confirmed by laboratory experiments (A:6) - This has been proved in many experiments (B:9).

A further typical characteristic in the simplified version is the addition of explicit markers of sentential relations where this explicitness has been reduced by deletions:

> Laughter is a reflex, but unique in that ... (A:16) - Laughter is a reflex, but it is different ... (B:27)

Although the information flow or the original has in general remained intact, version B indicates that some changes in the information structure are being made especially through the deletion of irrelevant information or the addition of new information in the form of examples or glosses. The

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chief result of syntactic simplification using variables such as those mentioned above is the addition of redundancy to the sentence structure. While denseness may be a virtue in authentic text, it may cause problems for the foreign language learner, since he tends to require a greater number of overlapping cues than the native reader. The aim of syntactic simplification, then, is to increase the number of redundant clues to structure and meaning. To what extent these variables are actually used remains unclear. Preliminary observations by this writer, based on five simplified readers from a series of published simplifications, indicate that the number of syntactic parameters actually available to simplifiers may be quite limited. Neither is it obvious that the use of these variables will automatically facilitate processing, since syntactic dilution may obscure aspects of text and discourse structure.

Text and discourse factors. Even less definite than the syntactic factors is the set of parameters of processing complexity or simplicity in the domain of text or discourse (cf. Lautamatti 1979).

Following Enkvist (1975), a 'text' may be viewed as a combination of predications, text atoms, held together by cohesion achieved through various linguistic mechanisms. Underlying these linguistic phenomena there is the pragmatic structure of 'discourse' (Widdowson 1978; cf. also Allen and Widdowson 1978), ie. a coherent development of propositional and illocutionary content. In general, though not necessarily, linguistic (text) cohesiveness and pragmatic (discourse) coherence stand in a co-occurrence relationship.

The input that the reader of a first or foreign language deals with is the formal linguistic combination of predications. Textually, the reader's task is to process the links of these predications, since it may be assumed that comprehension entails the reconstruction of the original set of predications from the surface form of the written message. At the same time, the reader is engaged in processing at another level: he must analyse the pragmatics of the text; ie., he must find out what the underlying structure of the argument is like, and what communicative functions the text is intended to serve. Discourse parameters of simplification may therefore be expected to fall under two types: those relating to linguistic cohesion, and those related to pragmatic coherence. A simplified text, pseumably, is characterised by overt marking for the two types of organisation in the surface linguistic form.

Enkvist's (1975) term 'text strategy' implies a possible set of factors connected with pragmatic coherence. Text strategy is the conscious or sub-

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conscious overall plan or program that the text constructor employs in selecting propositional content and linearising his predications. It reflects the underlying discourse-level organisation that the writer has in mind. A typical strategy in narrative text is the ordering of textual segments according to the actual temporal organisation of the events discussed. This strategy is almost automatically selected in texts where the purpose is to explain certain processes in detail, as in operation manuals, etc. Psycholinguistic evidence from L1 acquisition suggests that this kind of organisation is fundamental (cf. the 'order of mention' principle demonstrated by E. Clark 1971). Although corresponding work on foreign language learners has yielded less clear experimental results (see Cook 1977), it is still a reasonable hypothesis that such strategies of discourse organisation contribute to the ease with which a text is processed by learners. Such 'unmarkedness' of discourse organisation may enable the learner to bring his language-independent pragmatic expectancies to bear on the processing task. - Other general strategies of this type include the familiar inductive vs. deductive organisation, and the linearisation of the argument according to the primacy of either cause or effect.

Other factors which may have an effect on the simplicity of processing are related to thematic structure, ie. the organisation of the text with reference to the main topic and subtopics of discourse and the linguistic features used to mark this organisation. Lautamatti's observation (1978), based on four simplified versions of a short informative passage, was that simplifiers tend to have an intuitive preference for making sentence-initial grammatical subjects coincide with discourse topics. Combined with syntactic segmentation of complex sentences into a series of independent clauses, this may in fact complicate the topical development and lead to potential difficulties for the reader in distinguishing textual 'highlights' from peripheral information. A related parameter here is 'theme dynamics' (Enkvist 1973). Theme <u>iteration</u> (termed 'parallel development' by Lautamatti 1979), ie. organising the text around a single theme or a limited number of themes and presenting the new information in relation to these few topics, may make the text easier to handle. Lautamatti (1978) found that at least some simplifiers tended to favour this technique. The obvious psycholinguistic explanation for the potential facilitating effect of theme iteration is that the receiver does not have to keep changing his address systems: during processing, new information is continously being added to a single address (represented by the theme of the passage). Theme <u>progression</u> ('sequential development'), whereby the rhematic element of a sen-

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tence becomes the theme of the next sentence, to which new information is again added, may demand more processing capacity, owing to a hierarchical and more involved textual structure, and a constant shifting of the 'pegs' on which new information is hung.

Simplicity of processing is also likely to be increased by the presence of explicit linguistic markers of discourse structure. Among the various types of such material, metatextual devices are probably the most important. These are paragraphs, sentences, clauses or words which do not contribute to the topic or information content being handled in the passage, but rather give the receiver indications to the internal organisation followed by the author. It may also be expected that a simplified text will include a wealth of such explicit markers of textual cohesion as connectors, pronominal reference and repetition.

Some examples of the above parameters may be found in version C, where the simplifier has modified discourse and text structure to some extent, thereby producing a simple account of the information given in the original text. The construction of a simple account starts from an analysis of the basic information structure of the original.

Taken as discourse, the original version A serves a general informative function, and presents roughly the following argument:

1. Laughter = reflex, since:
   (1) reflexes = automatic, stereotyped
   (2) laughter = stereotyped, scalar in intensity, modifiable by higher nervous centres (as are most reflexes)

2. (Laughter = reflex) = paradox, since:
   (1) reflexes have biological survival value
   (2) laughter serves no such "useful" function

The organisational strategy chosen by the author is roughly 'deductive': the two main points are stated in A:1 and A:13, with subsequent justification. However, there is little metatext, and a quick reading of the passage does not in fact produce an immediate sensation of simplicity and clarity.

The reason may be that the organisation of the passage as discourse and the macro-level topical development is relatively complex. The first sentence establishes the overall topic (laughter), but after a theme progression to the notion of reflex, the entire first paragraph deals with this subordinate topic. The second paragraph returns to the main topic, but proceeds immediately to a treatment of the subtopic of muscle contraction patterns (A:6), and establishes the scalar nature of this muscle activity. This central new information of the second paragraph then appears as the topic of A:9 (the initial sentence of the third paragraph). Here the new information receiving

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the main emphasis is that the gradations in intensity explain the rich variety of laughter; the important assumption that the gradation is a characteristic of reflex action is given considerably less prominence. The possibility of a reflex being consciously controlled, which is important for the argument that laughter is a true reflex in spite of conscious modification, is not developed into a main point, but is presented as a subtopic in the discussion of variety of forms of laughter (A:11). The fourth paragraph takes up the second main point. The notion of the motor reflex is introduced, and the new information presented about them is their utility. The main topic of the paragraph is then clarified through the re-introduction of the laughter reflex and the presentation of the new information that it serves no utilitarian function.

The production of a simple account such as version C involves taking the propositional and illocutionary content of the original version, and turning it into a 'genuine' albeit non-authentic piece of discourse. In this process, considerable selection and reduction of syntax and vocabulary takes place; one consequence for version C is the further decrease in mean sentence length (C=16.6 words), and an increase in the proportion of simple main clauses. As the simple account is intended to emphasise coherent development of main ideas, a certain amount of subsidiary information is usually dropped, as is evident from version C.

Version C also provides examples of the principle of making the logical connections between the ideas expressed as explicit as possible. For example, the third paragraph of the original (A) had placed the information about intensity variation in reflexes in a textually non-prominent position. In the simple account, this piece of information has been moved to a position where it may help the reader follow the argument. Another example of an attempt to increase coherence is C:12-13, where the information that laughter is still a reflex although it can be consciously controlled is now presented with more emphasis than in A:9-12. Thus, the reader of a simple account is not expected to supply too much information from his knowledge of the world, or to read between the lines. Instead, an attempt is made to develop a clearer referential field for him through making discourse coherence more evident by some reorganisation of content.

In addition, discourse coherence has been emphasised by the introduction of metatext, as in the beginning of the first and fourth paragraphs of version C.

The simple account also involves the use of a wealth of explicit markers of logical sentence connection, such as the sentence-initial con-

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juncts of C:3,9,11. While it is not entirely certain that secondary school students, for example, can make good use of connectors[1], it is possible that recognition here precedes production, and that the addition of these indicators of textual relationships may help the reader to structure the text - a hypothesis which would deserve some experimental work.

Version C also displays increased grammatical cohesion through repetition, use of coreferential noun phrases, anaphoric pronominal reference, etc. This is also noted by Lautamatti (1979), who points out that the use of pronominal reference is natural in FL situations since closed-system items are easily remembered and since omission of subsidiary material from simplifications increases the need for clarity of reference. An additional and perhaps even more natural explanation may be that syntactic dilution is a primary technique even in the production of simple accounts. The increased use of cohesive devices such as pronominal reference is an automatic consequence of the increase in the number of simple sentences.

The examples of discourse parameters mentioned above, whether relating to pragmatic coherence or to linguistic cohesion, can again be interpreted as means of adding explicit structure to the text to be processed by the learner. Essentially, then, textual simplification also seems to deal with the addition of redundancy to the text at various levels. What seems to be less evident is which, if any, of the possible parameters actually facilitate the processing of the text, and whether the manipulation of rhetorical structure or textual cohesion is equally central for the learner as syntactic and, above all, lexical factors.

A concluding remark

Although authenticity is a desirable quality in foreign language teaching texts, FL instruction obviously cannot be based solely on authentic material. It may be possible to find texts written for different levels of native readers and to make occasional use of these as FL teaching materials, but it seems likely that simplification as a pedagogical technique will remain an unavoidable necessity at certain levels. Furthermore,

[1] Cloze test results from both native English and Finnish speakers and secondary school students of English as a foreign language seem to indicate some lack of ability to supply connectors even though the central ones form a relatively closed set (Tommola, in preparation); and learner's essays often display a one-sided preference for coordination with and (Jaakkola 1976).

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it also seems that such simplification will involve, to some extent at least, the simultaneous modification of both 'usage' and 'use'. The purpose of simplification is to improve the learner's probabilities of being successful in the processing of the material. The investigation of the various factors which make up processing complexity is a central domain of psycholinguistic study. A psycholinguistic approach to FL performance therefore seems profitable even in the study of simplification.

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Appendix A:

The laughter reflex[1]

1 Laughter is a reflex. 2 The word reflex, as Sir Charles Sherrington said, is a useful fiction. 3 However much its definitions and connotations differ according to various schools - it has in fact been the central battleground of psychology for the last fifty years - no one is likely to quarrel with the statement that we are the more justified to call an organism's behaviour 'reflex' the more it resembles the action of a mechanical slot-machine; that is to say, the more instantaneous, predictable, and stereotyped it is. 4 We may also use the synonyms 'automatic' 'involuntary' etc., which some psychologists dislike; they are in fact implied in the previous sentence.

5 Spontaneous laughter is produced by the co-ordinated contraction of fifteen facial muscles in a stereotyped pattern and accompanied by altered breathing. 6 The point to retain about this contraction is that it displays a continuous scale leading from the faint smile to Homeric laughter, confirmed by laboratory experiments. 7 Electrical stimulation of the zygomatic major, the main lifting muscle of the upper lip, with currents of varying intensity, produces expressions ranging from smile to broad grin to the facial contortions typical of loud laughter. 8 Films made of tickled babies and of hysterics to whom tickling was conveyed by suggestion show the reflex swiftly increasing from the first faint facial contraction to paroxysms of shaking and choking - as the quicksilver in a thermometer, dipped into hot water, rapidly mounts to the red mark.

9 These gradations of intensity not only demonstrate the reflex character of laughter but at the same time provide an explanation for the rich variety of its forms - from Rabelaisian laughter at a spicy joke to the rarefied smile of courtesy. 10 But there are additional reasons to account for this confusing variety. 11 Reflexes do not operate in a vacuum; they are to a greater or lesser extent interfered with by higher nervous centres; thus civilized laughter is rarely quite spontaneous. 12 Amusement can be feigned or suppressed; to a faint involuntary response we may add at will a discreet chuckle or a leonine roar; and habit-formation soon crystallizes these reflex-plus-pretence amalgams into characteristic properties of a person.

13 I have taken pains to show that laughter is, in the sense indicated above, a true reflex, because here a paradox arises which is the starting point of our inquiry. 14 Motor reflexes, usually exemplified in textbooks by knee-jerk or pupillary contraction, are relatively simple, direct responses to equally simple stimuli which, under normal circumstances, function autonomously, without requiring the intervention of higher mental processes; by enabling the organism to counter disturbances of a frequently met type with standardized reactions, they represent eminently practical arrangements in the service of survival. 15 But what is the survival value of the involuntary, simultaneous contraction of fifteen facial muscles associated with certain noises which are often irrepressible? 16 Laughter is a reflex, but unique in that it serves no apparent biological purpose; one might call it a luxury reflex. 17 Its only utilitarian function, as far as one can see, is to provide temporary relief from utilitarian pressures. 18 On the evolutionary level where laughter arises, an element of frivolity seems to creep into a humourless universe governed by the laws of thermodynamics and the survival of the fittest.

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[1] Koestler, A. The Act of Creation. Hutchinson & Co., London 1964, pp. 28-30. Reprinted by permission of A D Peters & Co Ltd. For the purposes of this paper, the original passage has been modified by deleting a lengthy quotation from between sentences 5 and 6, and by slightly changing the wording of sentence 6.

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Appendix B:

The laughter reflex

1 Laughter is a reflex. 2 The word reflex is a useful term in psychology, but its meaning is not always clear. 3 In fact, the notion of 'reflex' has been the central battleground of psychology for the last fifty years. 4 However, no one is likely to quarrel with the statement that an organism's behaviour is reflex-like if it resembles the action of a cigarette machine: when you put in a coin, you know what you will receive; the machine produces the cigarettes at once; and it always responds in the same way. 5 In other words, reflexes are typically predictable, instantaneous, and stereotyped.

6 The movements of the face during spontaneous laughter are produced by the co-ordinated action of fifteen muscles, and they are accompanied by altered breathing. 7 The pattern of this muscle action is stereotyped. 8 Another important point to note about this muscle action is that it can vary along a continuous scale. 9 This has been proved in many experiments. 10 If the zygomatic major, the main lifting muscle of the upper lip, is stimulated with electric current of varying strength, this produces expressions which range from a smile through a broad grin to the twisting of the face typical of loud laughter. 11 The same continuous scale can also be seen in films made of babies which are being tickled. 12 The reflex increases quickly from the first small twist of the facial muscles to violent shaking and choking - just as the quick-silver in a thermometer rises swiftly when the thermometer is put into hot water.

13 These degrees of intensity in the laughter response demonstrate the reflex character of laughter. 14 They also explain why laughter takes so many different forms. 15 But there are also other explanations for the variety in the forms of laughter. 16 One is that reflexes can be modified by higher nervous centres. 17 Thus, civilised laughter is rarely quite spontaneous. 18 It is possible to pretend to be amused, and it is just as possible to suppress laughter. 19 To the basic reflex response we may consciously add a quiet chuckle or a laughter that resembles the roar of a lion.

20 I have taken pains to show that laughter is a true reflex. 21 My reason for emphasising this is that here a paradox arises which is the starting point of our inquiry. 22 Motor reflexes, such as the familiar knee-jerk or the adjustment the eye makes to bright light, are relatively simple, direct responses to equally simple stimuli. 23 Reflexes such as these operate automatically under normal circumstances, and higher mental processes play no part in them. 24 Their function is to enable the organism to react quickly to certain common disturbances. 25 In this way, reflexes are very useful aids to survival. 26 But what is the survival value of the reflex-like action of fifteen facial muscles and the accompanying noise? 27 Laughter is a reflex, but it is different from all other reflexes, because it serves no clear biological purpose. 28 One might call it a luxury reflex. 29 Its only useful function seems to be that it provides a way of forgetting the pressures of having to be useful. 30 At the point of man's evolution where laughter developed, a spark of humour seems to have entered the humourless universe governed by the laws of thermodynamics and the survival of the fittest.

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Appendix C:

The laughter reflex

1 Let us start our study of laughter as a reflex by looking at the term 'reflex'. 2 The word is widely used in psychology, but it is often given quite different meanings. 3 However, many people would agree that the behaviour of an organism is a reflex if it resembles the action of a cigarette machine: when you put in a coin (the stimulus), the machine always acts (responds) quickly, and in the same way. 4 A reflex is a quick, automatic response which always takes roughly the same form. 5 Another characteristic of a reflex is that the strength of the response can vary depending on how strong the stimulus is.

6 Now, the movements of the face during laughter are produced by fifteen muscles acting together. 7 The muscles of the face always act in roughly the same way during laughter. 8 In addition the strength of this muscle action (the laughter response) can vary. 9 For example, suppose you give tiny electric shocks to the zygomatic major (the muscle that lifts the upper lip), and vary their strength. 10 The result is a scale of face movements that goes from a little smile all the way to the twisting of the face that takes place during loud laughing.

11 Thus, laughter and reflexes seem to have much in common. 12 It is true that you can control your laughing: you may choose not to laugh although the joke was funny, or you may think you had better laugh even though the joke was not funny. 13 But even so, laughter is like a reflex, since to some extent reflexes, too, can be controlled.

14 Above, I have tried to show that laughter is a real reflex. 15 My second main point is that it is a very strange kind of reflex. 16 To see why this is so, think for a moment about a typical reflex, say, the way you pull your hand away if you happen to touch something hot. 18 These kinds of reflex actions are necessary for us. 19 They make it possible for us to react automatically and quickly to certain things that might be dangerous. 19 It may be that man has survived only because he has developed quick reflexes like these. 20 But what about laughter? 21 What is the usefulness of the laughter reflex? 22 Laughter is a reflex, but it is different from all other reflexes, because it serves no biological purpose. 23 Its only purpose is pleasure. 24 It is a luxury reflex.

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